

SOME OBSERVATIONS ON TIGER BEHAVIOUR IN THE CONTEXT OF BAITING¹

CHARLES McDUGAL²

(With a text-figure)

This paper deals with the response of tigers to regular baiting, that is, the provision of a steady and localized food supply in the form of young buffaloes tethered at specific sites in localities frequented by tigers, where disturbance is minimal. The primary objective of the baiting has been to afford tiger viewing by tourists. Nevertheless, the baiting situation also may be viewed as a type of experiment which holds constant many environmental factors so that individual response may be assessed and the range of behaviour determined. It provides an opportunity for making quantitative observations on certain aspects of behaviour not possible by other field methods.

The Record from Baiting at Tiger Tops: 1972-79

Tiger Tops Jungle Lodge, located in Nepal's Royal Chitawan National Park, has been regularly baiting for tigers since 1965, but no records were kept before I joined the staff in 1972. Since then I have been able to document the response of different individual tigers to the baiting situation. Young male buffaloes are tethered at fixed places almost every night from October through June. In the beginning I continued to bait throughout the monsoon also, for I then believed that this practice would habituate the tigers to the baits and

ensure that their visits became regular. However, I discovered that monsoon baiting had no effect on the frequency with which baits were visited for the remainder of the year, so it was discontinued.

The first essential of any serious study of these animals is the ability to recognize individuals. Tigers have distinctive facial and other individual markings, and so can be identified by careful observation. This is facilitated by the baiting situation when they can be seen for prolonged periods. Observations are made from blinds overlooking the baiting sites at distances of approximately 50 metres, using powerful binoculars, aided at night by a spotlight—to which, incidentally, the great majority of tigers react very little. Tigers positively identified by individual markings are counted as having visited the bait site; doubtful observations are discarded.

My records cover the two bait sites near Tiger Tops Jungle Lodge which have been used at more or less the same locations continuously since 1972 (and even prior to that when no records were kept); a site used at Mohan Khola near Tiger Tops Tented Camp from 1973-76; and finally a site used on Bandarjholi Island, where the Tented Camp was shifted, from 1976-79.

A total of 17 individual tigers, excluding dependent young, have been identified at one or more of these sites during 1972-79, nine males and eight tigresses.

Many persons believe that baiting overtime

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² Tiger Tops Jungle Lodge, P.O. Box 242, Kathmandu, Nepal.

results in important changes in the behaviour of the tigers concerned. The most common assumptions are: (1) that it leads to a dependence on the baits on the part of the tigers; (2) that it causes an artificial concentration of tigers in the area where baiting occurs; and (3) that it leads to increased intra-specific aggression, with resultant casualties to the tiger population. Before setting down the results of the study, it is necessary to demonstrate that none of these assumptions is correct, using what certainly is the most comprehensive record of baiting that is available. While I do not deny that tigers are attracted to baits—especially under certain circumstances which will be discussed later—I contend that the overriding dictates of this super predator's adaptive strategy, successfully evolved over a long period of time, prevent these changes in behaviour from taking place.

The Question of Dependency

Since baiting only is done for nine months of the year and discontinued for three, the question of complete dependence does not arise. Moreover, there is ample evidence that, while a given individual may make frequent use of the baits for a temporary period to supplement natural prey, a change in circumstances unrelated to the baiting situation may cause that tiger to revert almost completely to natural prey. Let me cite a few examples.

The two resident tigresses exposed to the baiting situation for the longest periods are one named Chuchchi, who has maintained a home range in more or less the same area from 1972-79 (and who since 1978 has been

radio-collared by the Smithsonian Tiger Ecology Project); and another named Bangi, first identified in 1974, since when she has been Chuchchi's western neighbour.

During a four and a half year period from mid-1974 to the end of 1978, there has been a complete reversal in the relative frequency with which these two tigresses have been observed at the bait sites. During the first two years Bangi was seen 43 times and Chuchchi only five times—sometimes Bangi even was seen at the eastern, Surung, bait site, well within Chuchchi's home range. When this period began, Bangi had small cubs, while Chuchchi lacked cubs. Chuchchi bore a litter a year later (mid-1975), after which Bangi stopped using the Surung site; thereafter the site further west at Dhakre Khola was the only one used jointly by the two tigresses.

During the next year, mid-1976 to mid-1977, Bangi and Chuchchi were seen with almost equal frequency, the former seven times and the latter eight times. Neither had cubs during this period, those of Bangi having become independent and those of Chuchchi having disappeared without a trace before reaching a year of age.

Then, in mid-1977 Chuchchi had another litter. During the two years which followed she was seen at the bait sites 29 times, most often when her cubs became large. Bangi bore cubs a couple of months after Chuchchi. Nevertheless, she was not observed even one time during the same two-year period, despite the fact that she patrolled on many occasions up to Dhakre Khola—the boundary between the two tigresses' territories since mid-1975—where baits are regularly placed.³

In this example the food supply has remained the constant factor. Nevertheless, the individual responses of the two tigresses varied

³ Although not observed at the regular bait sites. Bangi was seen three times at a special site further west used for filming.

inversely. This was due to factors not directly related to the baiting situation. These factors are outside the scope of this paper, but we may state parenthetically that dominance is almost certainly one of them, and moreover that dominance appears to be relative, and to be linked with reproductive status. A tigress having young cubs may be dominant over one lacking cubs, and may maintain her dominance even if the latter produces a litter a short time later. However, the point to make here is that although Bangi was a regular visitor for two years there is no question of her having become dependent on the baits, for since she stopped using them she has been living successfully on natural prey and has managed to raise a litter of three cubs to the point where they now (April 1979) are able to kill for themselves.

Another example is that of the large male tiger No. 105 (radio-tagged by the Smithsonian project). He first appeared in western Chitawan in September 1976 shortly after the death of the former resident male who previously had been his western neighbour; he began to extend his movements in an attempt to include most of the dead tiger's former territory within his own. At maximum expansion (February 1977) he ranged all the way from Saurah in the east to Mohan Khola in the west, a linear distance of over 40 km. Within a year he impregnated six known tigresses and possibly a seventh. During that year he was observed five times at our bait sites. The next year (mid-1977 to mid-1978) his westward movements were more restricted, another male having established himself west of Dhakre Khola, but he still included the home

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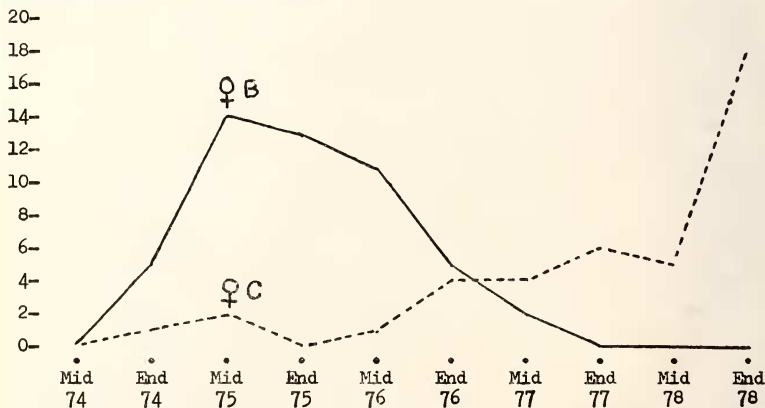


Fig. 1. Relative Frequency of Observations of Tigresses Bangi and Chuchchi at Bait Sites.

ranges of six resident adult tigresses within his territory, and had access to one or two others. He impregnated two of the resident females (one for the second time). He was seen at Tiger Tops bait sites no fewer than 27 times. Nevertheless he continued to patrol his extensive territory, making an average of three trips per month between his eastern and western boundaries, on one occasion covering 20.5 km in less than 12 hours.⁴ During the first half of the year he also occasionally used baits put out by the Smithsonian project at Jarneli on the eastern side of the park; even after baiting was discontinued there he continued his patrols to that area with some regularity. One was tempted to say that, far from tending to localize him, the use of baits—together with an east to west road down the long axis of the area over which he ranged—facilitated the maintenance of a large territory. However, the last—not quite complete—year (mid-1978 through March 1979) he has been seen only eight times. During this period he re-mated with five known females.

While allowing that the bait sites, and the resource which they provide, are an attraction, used most frequently during a critical period of the animal's life cycle, we find no evidence that individual tigers become dependent on this easy, regular, and localized supply of food.

The Question of Artificial Concentration

The first point to make here is that tigers are territorial animals; they maintain their territories, patrolling and marking them, whether they come to the bait sites or whether

they do not.⁵ Were the use of baits to affect the tiger's ability to maintain its territory, then one would expect that those individuals that visit bait sites would have smaller territories than others. This is not so, since even baited tigers only use this resource when they visit the area in the course of normal patrolling—the remainder of the time they are visiting other parts of their territories. All evidence indicates that the territories of tigers in western Chitawan having access to sites which are regularly baited are just as large as those in eastern Chitawan where they do not. One eastern resident adult tigress monitored by radio-telemetry for 14 months in 1975-76 maintained a territory of 30 km²; another monitored for 12 months one of 26 km² (Sunquist, Tamang, and Troth 1976: 7). During roughly the same period, of two resident western females whose movements I monitored by pugmark tracking, one used an area of 30 km² and the other one of 39 km² (McDougal 1977: 69). Radio-tagged male 105 at the eastern end of the park covered 62 km²; the Dhakre Tiger (102) moved over 100 km². More recently, of six radio-tagged tigresses monitored by Smith the largest territory was that of the tigress Chuchchi (23.5 km²), who during that period used both of the bait sites near Tiger Tops Lodge (Smith 1978: 15).

The density of tigers in western Chitawan, where regular baiting occurs, is not greater than in the eastern part of the park. Secondly, although the total number of tigers in western Chitawan has fluctuated over the years due

⁴ This is based on a combination of radio tracking by the Smithsonian project and pugmark tracking by myself. The data on some of the pregnancies were provided by David Smith of the Smithsonian project; others are from my own observations. See Smith 1978.

⁵ Male tigers maintain large home ranges which encompass the smaller ones of several females. In both cases the entire home range, held more or less exclusively with little overlap, and defended by advertisement, may be considered a territory.

to births, deaths, and dispersal, the number of resident adults has remained almost constant.

The example of male 105 given in the preceding section shows that a bait site does not localize an animal. The tigress Bangi used as large an area during the time she was visiting the bait sites as that which she ranged over during the two years since her visits stopped.

The Question of Increased Aggression and Mortality

The third allegation is that regular baiting leads to more intra-specific aggression as tigers compete for the important resource afforded. From 1973 to the present we have observed two or more tigers (excluding dependent young) associated at a kill of one of the baits on no fewer than 88 occasions. Aside from occasional growling/snarling, and even this in a minority of observations, only two displays of aggression have been seen.

Tigers view these meetings at kills as situations of potential conflict, and have evolved behaviour for such occasions which minimizes the possibility of conflict actually taking place. Typically one animal feeds at a time, while the others lie spaced out, a few metres apart, scrupulously respecting individual distance. Also there is tacit recognition of the prior right to the prey by the tiger that killed it, as first pointed out by Schaller (1967: 250), and confirmed by my own observations, at least in principle (McDougal 1977: 141-42). A tiger arriving in the vicinity of the kill site when another already is present, advertises its lack of aggressive intent by an almost ritualized approach.

Selectively tolerant, tigers will associate amicably with certain conspecifics at kills, but not with others. The factors involved are not

all clear, but competition is one of them. Non-competitors may be tolerated, competitors are not. Males compete among themselves for females, while females compete for land/food resources for raising their young. Kinship also is a factor. Fathers tolerate sons and mothers daughters until such time as the offspring begin to become competitors.

It is true that tigers who are competitors may visit the same bait site, but they do so at different times. Their behaviour is calculated to avoid confrontations. Nevertheless, mistakes do happen and competitors meet. I know of two instances in which a young subadult tiger was chased away from a baiting site by an older male; in neither case did he ever return there.

Aside from one case in 1970 when two cubs less than a year of age were killed by an intrusive male close to a bait site, 14 years of regular baiting by Tiger Tops has resulted in no fatalities or even serious casualties.

Sex and Age Variation in Response to Baits

In my opinion we can use the baiting situation as a type of experiment which may shed light on a number of different aspects of tiger behaviour. One factor, the food resource provided by the baits, is held constant. Against this we can test the variability of other factors. To illustrate this, I consider two examples, the first being sex/age variation and the second seasonal variation.

To examine sex/age variation we will look at the six year period mid-1972 to mid-1978. The sex age categories are adult male, subadult male, adult female, and subadult female. We are excluding dependent young. Subadults are 18-36 months of age, adults over three years of age (any tiger reaching the age of three during the course of a given year is

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counted as adult for that entire year). The sex/age breakdown year by year is as follows:⁶

	72-73	73-74	74-75	75-76	76-77	77-78	Total	Per cent
A Male	—	2	2	1	1	3	9	25.0
SA Male	1	1	—	—	3	—	5	13.9
A Female	2	3	4	3	3	3	18	50.0
SA Female	—	1	—	1	2	—	4	11.1
Total	3	7	6	5	9	6	36	100.0

The number of observations of tigers in each category is shown below:

	72-73	73-74	74-75	75-76	76-77	77-78	Total	Per cent
A Male	—	51	23	16	20	58	168	27.1
SA Male	18	77	—	—	124	—	219	35.0
A Female	6	77	58	31	27	14	213	34.2
SA Female	—	8	—	2	13	—	23	3.7
Total	24	213	81	49	184	72	623	100.0

One major point is that if we lump together adults and subadults, females are a higher proportion (61 per cent) of the total number of tigers than are males (39 per cent). Nevertheless, far more males (62 per cent) were seen than females (38 per cent), inversely proportionate to their representation in the sample. The second thing that stands out is that subadult males were observed more often than any other category even though they constitute only a small proportion of the sample.

Were all other factors held constant, we might expect that the number of observations of each sex/age category would be proportional to its representation in the total number of tigers using the baiting sites. Actual observations are compared with expected frequen-

cies below:

	Expected	Actual
A Males	156 (25.0%)	168 (27.1%)
SA Males	87 (13.9%)	219 (35.0%)
A Females	311 (50.0%)	213 (34.2%)
SA Females	69 (11.1%)	23 (3.7%)
Total	623 (100%)	623 (100%)

Although the number of actual observations corresponds closely with the expected number in the case of the adult males, this is not true of any other category. There were two and a half times more observations of subadult males than would have been expected from their representation in the total number of tigers. On the other hand, both categories of females were observed much less frequently than would have been expected.

Focusing on adult females, if we divide them into those having offspring one to two years old, on the one hand, and those having younger cubs or no offspring, on the other, we find a significant difference.

⁶ These figures differ slightly from those given in a different version of this paper presented at The International Symposium on Tiger in New Delhi in February, 1979, due to an error in calculation in that paper for the year 1976-77.

	Expected	Actual
Adult females with		
1-2 year old offspring	68 (11%)	105 (16.9%)
Adult females with young		
cubs or no offspring	243 (39%)	108 (17.3%)

Females with large offspring were observed more frequently than would have been expected from their representation in the total, other tigresses much less frequently.

We may say that the different sex/age categories of tigers are attracted to the baits in the following order, indicating what percentage of the expected frequency was realized by empirical observation:

Subadult males	252%
Adult females with 1-2 yr old cubs	154%
Adult males	108%
Adult females with small cubs/ no cubs	44%
Subadult females	33%

These findings pose some challenging questions. Why the dichotomy between males and females generally? The answer must be that it reflects the different roles/strategies of the two sexes. All available evidence indicates that the ratio of the sexes at birth is parity. In a sample from Royal Chitawan National Park, where seven known tigresses had 20 cubs at an average age of nearly 14 months, the ratio was 3:2 in favour of males. However, in the adult population the ratio is 4:1 in favour of females. This strongly indicates that a high proportion of male mortality occurs during the subadult phase of life; attrition on subadult females is less. Few subadult males that strike out on their own after independence survive to establish territories of their own, most of them dispersing to the periphery where habitat is suboptimal and natural prey more difficult to secure. Competition is intense, and continues

into adulthood—on the part of those who survive—as males compete for larger territories containing more females. Although caution and discretion are essential to any tiger's survival, within the context of intra-male competition, bold and enterprising behaviour probably is adaptive. This is reflected by the greater activity of males at bait sites. A male is most attracted to the baits during that critical, transitional, and very vulnerable period when he is a subadult. If he survives to grow into an adult and manages to establish a territory of his own, then he cannot afford to localize himself in the vicinity of a bait site. Otherwise he will not be able to maintain his territory and visit the tigresses it contains. If he is not out there patrolling and marking his territory, it will not be his for long. So long as he does this he may regularly use a bait site in the course of patrolling an area which contains one, but soon moves off to another area. In fact, the use of baits from time to time, saving energy which would otherwise be expended in the pursuit and capture of natural prey, may even facilitate better territorial patrolling.

The female, on the other hand, ensures her survival and that of her offspring especially by maintaining a low profile. Having a smaller range her use of it is more intensive, more fine-grained as it were, than in the case of a male who must cover large distances and keep up the pace to frequently visit all the different parts of his territory. As a rule the female cub becomes independent somewhat later than the male cub, consequently benefiting from a longer period of maternal training, including the art of keeping out of trouble. One resident tigress, Bangi, invariably runs off like a shot the moment a light is shined on her, no doubt the result of a nasty experience

in her past. It was interesting to note that her female cub also took to doing this, whereas the males did not.

When a tigress has small cubs she is especially cautious and secretive. But a female with large, but still dependent offspring may experience difficulty in securing sufficient food for them. At the same time, by virtue of their size, the cubs are less vulnerable than previously. A tigress with such offspring finds the baits more attractive than do other tigresses.

Seasonal Variation in Response to Baits

Tigers are not observed uniformly throughout the months of the year when baiting is done regularly, i.e., October through June. Observations rise to a peak in the spring and then decline in frequency well before the monsoon. This is true of all sex/age categories.⁷

	O	N	D	J	F	M	A	M	J	J	T
A Males	7	9	21	18	22	27	22	18	12	156	
SA Males	3	16	14	21	35	52	39	20	19	219	
A Females	14	20	17	23	24	41	32	35	5	211	
S Females	1	1	—	2	6	8	2	3	—	23	
Total	25	46	52	64	87	128	95	76	36	609	

Looking at the month by month totals of all categories, over half (51 per cent) of the observations of tigers at the bait sites occurred during the three month period from February through April; the peak for all categories was March.

This period coincides with the time in Chitawan when the vegetation ground cover is most reduced as the result of annual fires that burn off the grassland and, to a lesser extent, forest undergrowth. A peak in tiger observations at

baits at the very time when ground cover is most limited strongly suggests that these cats are most attracted to the resource provided by the baits when their natural prey is least vulnerable. This correlation is reinforced by examining the records of observations of dependent young tigers, aged eight to sixteen months, that we from time to time made at our bait sites. If the baits are especially attractive when natural prey vulnerability is lowered, then this should be particularly true for a tigress with growing cubs to feed. In fact, 73 per cent of the observations of such cubs were made during the two months of March and April.

Nevertheless, even at this time of the year the tigers are not dependent on the baits. This can be illustrated by the incomplete year record mid-1978 through March 1979. At the two sites near Tiger Tops Lodge there were 63 observations of tigers during the four months October through January. Then suddenly the number fell from 21 in January to only two in February and one in March, the normal peak. Other events took priority over the attraction of the baits during this year. Towards the end of January the tigress Chuchchi had a new litter of cubs after an interval of only 19 months since her last ones were born. The latter had been visiting one of the bait sites regularly, in particular the young male who had been killing on his own for a few months. These offspring dispersed out of the area in January and have not been seen since. Chuchchi herself was not observed at the bait sites at all during February and only once in March. Again towards the end of January the two resident males had a fight west of Dhakre Khola in a area where their respective territories slightly overlap, at a time when one of them was mating with the tigress

⁷ The total figure of 609 omits 14 observations made during the months of July through September.

Bangi. Both were wounded in the fight, but neither seriously so. The western male had been seen ten times at the Dhakre bait site in the preceding four months; he was seen there only once in February and not at all in March. The eastern male who before had been observed seven times at the two Tiger Tops Lodge bait sites likewise was only seen once in February and not even one time in March.

All of these tigers have reverted almost entirely to natural prey, and have done so very abruptly; there is no evidence that they experienced any difficulty in the process. To cite a final case, a subadult male who was observed at bait sites no fewer than 37 times in 1976-77 thereafter disappeared. Suddenly he reappeared briefly in January 1979 after an absence of 19 months and was observed three times before disappearing again. During the interval he subsisted entirely on natural prey. When seen again he looked in prime condition.

DISCUSSION

To summarize, by recording the visits of identified individual tigers to bait sites it has been possible to quantify the differential response to this resource on the part of four sex/age categories, and to determine that males are more attracted to baits than females generally, although tigresses with large, dependent cubs are frequent visitors. Subadult males, however, are those most attracted, being seen more frequently than any other category despite the fact that they form only a small proportion of the total number of animals using the bait sites. Secondly, it has been determined that all four sex/age categories of tigers are most attracted to the baits when ground cover is most reduced by the action of fire—and presumably when natural prey species are

less vulnerable to these large, stalking predators.

There is no evidence that regular baiting has the results sometimes suggested: dependence on the baits, artificial concentration, and increased aggression. This is simply because tigers are subject to overriding pressures strong enough to prevent these things from happening.

Dependence on baits would be non-adaptive. The survival of the fittest means that some individuals are able to increase the proportion of their genes in subsequent generations. The male tiger, competing with others of his own sex, maximizes his genetic contribution by impregnating as many females as possible, and also by providing a stable situation for those tigresses to successfully raise his offspring. This he does by establishing a territory large enough to contain several tigresses, but not so large that he cannot effectively maintain it. Failure to do so will result in the intrusion of another male, who may cancel out his genetic contribution by killing or prematurely ejecting his offspring, and who will mate with the females. The adult male cannot afford to remain localized in the vicinity of a bait site; the consequence will be failure to maintain his territory. (However, the occasional use of a bait site during the course of normal patrolling activity may conceivably help the tiger to maintain it.) The subadult male, being non-reproductive and lacking a territory, is not subject to the same constraints; the resource afforded by the baits may enable him to hang on during that critical period before he is able to establish a place for himself.

A tigress ensures that her genes get into subsequent generations by successfully raising her offspring. She needs an area which is free

from competitors where she can train her young for survival and at the same time keep them out of harm's way. There is less demand on her time to maintain her territory because it is much smaller than that of the male, but neither can she afford to remain too localized, as this increases the vulnerability of her cubs, at least when they are small. The more cautious and secretive she is, the less risks to which she subjects the cubs, the better the chances they will survive to the point where they can fend for themselves. She cannot afford to rely on baits if she is going to raise her offspring successfully, although they may help her through a critical period when the cubs are large enough to have lost much of their vulnerability but still are primarily dependent on her for food, especially during that time of the year when it is most difficult to secure natural prey, and also especially if her litter is a large one.

Baiting does not result in artificial concentration of tigers in the vicinity of a bait site over any period of time due to the very efficient spacing behaviour which tigers have evolved, behavior which appears designed to prevent the population from rising in response

to temporary abundance of prey. If the number of predators was geared to the time when prey was most available, the predators would be in serious trouble when prey was least abundant. These highly adaptive patterns of behaviour are not going to be changed by a few years of baiting.

Increased aggression does not result from baiting because tigers long ago evolved behaviour to deal with such situations, behaviour which minimizes the possibility of conflict. An essentially solitary animal dependent on its own efforts to secure food, the tiger cannot afford the luxury of uninhibited aggression; incapacitation is probably a death sentence. Well armed, but thin skinned, it is difficult to inflict injury on a conspecific without the risk of receiving injury. Tigers visiting the same localities know one another individually. There are some with whom an encounter to share a kill may be tolerated or perhaps even enjoyed, but in these cases a dominance order and the demonstration of friendly intentions reduce the chances of a conflict. There are others with whom an encounter is to be avoided. Marking and other means of advertisement help to avoid confrontations.

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